PEER REVIEW HISTORY

ARTICLE DETAILS

TITLE (PROVISIONAL)	Cannabis use among workers with work-related injuries and illnesses: results from a cross-sectional study of workers' compensation claimants in Ontario, Canada
AUTHORS	Carnide, Nancy; Nadalin, Victoria; Mustard, Cameron; Severin, Colette; Furlan, Andrea; Smith, Peter

VERSION 1 – REVIEW

REVIEWER	Zhang , Joyce C University of Toronto, Occupational Medicine
REVIEW RETURNED	08-May-2023

GENERAL COMMENTS	I read with great interest the cross-sectional study by Carnide et al on the cannabis use patterns among workers with work-related conditions. The authors examined the cannabis use patterns of over 1000 workers in Ontario who experienced a work-related injury or illness resulting in one or more days lost time. A significant percentage of these workers (27.4%) reported having used cannabis in the past year for either work-related or non-work-related conditions. The authors found that workers who use cannabis for their work-related conditions were less likely to be working, more likely to have pain, psychological distress, and sleep issues. The percentage of workers receiving clinical guidance for the use of cannabis to treat their work-related condition is low at only 20.4%. In the introduction, the authors outline the increasing awareness of the use of cannabis for therapeutic purposes, yet there is limited understanding of how injured workers use cannabis for recovery or return to work. The study sets out to compare the characteristics of workers who use cannabis for the treatment of their work-related injuries vs not, and among those who reported using cannabis, if there are differences between workers who use cannabis for work-related injuries vs. not. The study participants were recipients of WSIB benefits (which covers about 70% of workers in Ontario) recruited for another study between 2019 to 2020 and Sept-Nov 2021. Of the 1000 participants successfully contacted, the majority were long-duration claimants (claim of over 3 months or more). Cannabis use status were divided into 3 groups – no past-year use, past year use for work-related condition, and past-year use for non-work-related condition. Worker's descriptors related to their socioeconomic status, health status, pain interference etc were recorded and compared using chi-square. A flow diagram describing how the authors arrived at the final cohort would be helpful. It is also not clear how workers would be classified if they

	reported using cannabis for both work-related and non-work-related reasons. In the results section, the authors reported demographical differences between the 3 groups based on cannabis use status, with most claimants reporting no past year cannabis use. Claimants who reported using cannabis for work related condition were likely to be male, born in Canada, have longer claim duration, not working, report more pain interference and severity, and use opioids. These claimants were also more likely to report daily use for treatment of their work-related condition (e.g. pain, mental health) and perceive to have decreased use of other prescription medications. Despite these reports, most of the claimants did not have medical authorization although around 30% of those using cannabis for work related injuries received some guidance from a health care provider. Discussion and comments The authors found that among their sample of 1000 claimants of Ontario's workers compensation benefits resulting in lost-day, 14% reported using cannabis for the treatment of their work-related condition. They overall had positive perception of the cannabis of their health, but few received physician guidance or medical authorization. Further, these workers are more likely to experience pain, prolonged recovery, poor mental health, and difficulties with sleep. Given the cross-sectional nature of the study, it is not possible, as the authors point out, to comment on cause and effect. It is not clear if these workers are using cannabis because of their difficult recovery or cannabis use is having a detrimental effect on their recovery. The authors have adequately discussed the limitations of the study which include cross-sectional design, recall bias, generalizability issues given the specific cohort studied. This is a hypothesis generating study in a unique cohort- injured workers. Delayed recovery and return to work can have significant impact on workers' mental and physical health, and understanding how cannabis use can affect the recovery process is a very salient issue in Canada today. What is undeniable is that a high percentage of injured workers can using cannabis for therapeutic purposes related to their workplace injury. The study highlights the opportunity for compensation boards to provide cannabis related healthcare guidance to workers return to work process. Future studies may wish to examine if cannabis use has a positive or detrimental impact on successful return to work in this population.

REVIEWER	McGregor, Iain University of Sydney, Lambert Initiative for Cannabinoid Therapeutics
REVIEW RETURNED	13-May-2023

GENERAL COMMENTS	The manuscript by Carnide et al provides a unique insight into the medical and non-medical use of cannabis by Canadian workers recovering from work-related injuries and illnesses. It involves a relatively straightforward survey and/or interview of a sample of workers' compensation claimants either at 18 or 36 months following their occupational injury/illness.

	Some 27.4% of the 1196 interviewees used cannabis, with around half of those using cannabis for their work-related condition (the final analysis for on n=147 for a work-related condition and n=140 using cannabis for other reasons). Around half of those using cannabis for a work-related condition started using cannabis to the treat that condition. Those using cannabis for the occupational injury had longer claim durations, were more likely to be unemployed, had poorer health, and were more distressed, and experienced more pain and insomnia. Cannabis use was associated with reduced use of prescription meds. Many of those interviewed were not receiving healthcare guidance around their cannabis use. Overall, I found this manuscript well written and of significant interest and only have some minor comments and suggestions for the authors. 1. Can the authors provide information on what a 'work-related illness' (rather than injury) might be. An injury is easy to understand (e.g. those listed at bottom of Table 1) but what is a typical "illness"? WSIB data were collected but not reported? 2. What proportion of illness is psychological i.e. are conditions such as trauma in first responders, or anxiety in those subjected to workplace bullying, represented in the cohort? 3. The relationship between return to work and the data collected at the 18 and 36 month time points is not entirely clear. What proportion of the cohort had returned to their original jobs? If time off work is short in some of the cohort how reliable is their recall over a 3 year period? Has cannabis use occurred throughout the 18 or 36 month interval? 4. The cannabis use data presented is somewhat impoverished: users only had to use cannabis on more than one occasion in the past year to be included in the cannabis-using cohort. A large proportion of the cohort reporting use for their WRC (i.e. around 50%) are using cannabis weekly or less which does question the relevance/importance of their cannabis use in relation to treatment of their occupational injury. Can this be commented upon? Don't typical medical users tend to be daily users? 5. Oddly, of those reporting cannabis use for WRC, only 44.9% say that their cannabis use has a medical purpose. This apparent paradox needs better explanation. 6. Some background explanation of the "medical authorization" scheme for cannabis would be welcome for non-Canadian readers. 7. In relation to doctor reluctance to prescribe cannabis in other jurisdictions, the recent Australian paper of Bawa et al (BMC Primary Care) is relevant. 8. It would be good to better understand the apparent paradox where cannabis using workers claim it is beneficial but that they are actually in more pain and distress. Presumably those with more intractable and chronic injuries are more attracted to cannabis? This is a theme that is already present in other studies in the literature (i.e. patients with more severe illness and more likely to be using cannabis, see e.g. Benson et al in IBD patients) and might be better elaborated upon by the authors. 9. Define abbreviation WRC.

VERSION 1 – AUTHOR RESPONSE

Reviewer: 1
Dr. Joyce C Zhang , University of Toronto

Comments to the Author:
I read with great interest the cross-sectional study by Carnide et al on the cannabis use patterns among workers with work-related conditions. The authors examined the cannabis use patterns of over 1000 workers in Ontario who experienced a work-related injury or illness resulting in one or more days lost time. A significant percentage of these workers (27.4%) reported having used cannabis in the past year for either work-related or non-work-related conditions. The authors found that workers who use cannabis for their work-related conditions were less likely to be working, more likely to have pain, psychological distress, and sleep issues. The percentage of workers receiving clinical guidance for the use of cannabis to treat their work-related condition is low at only 20.4%.

In the introduction, the authors outline the increasing awareness of the use of cannabis for therapeutic purposes, yet there is limited understanding of how injured workers use cannabis for recovery or return to work. The study sets out to compare the characteristics of workers who use cannabis for the treatment of their work-related injuries vs not, and among those who reported using cannabis, if there are differences between workers who use cannabis for work-related injuries vs. not.

The study participants were recipients of WSIB benefits (which covers about 70% of workers in Ontario) recruited for another study between 2019 to 2020 and Sept-Nov 2021. Of the 1000 participants successfully contacted, the majority were long-duration claimants (claim of over 3 months or more). Cannabis use status were divided into 3 groups – no past-year use, past year use for work-related condition, and past-year use for non-work-related condition. Worker's descriptors related to their socioeconomic status, health status, pain interference etc were recorded and compared using chi-square.

A flow diagram describing how the authors arrived at the final cohort would be helpful.

Authors' response: Thank you. In the original submission, we included Figure 1 which detailed the exclusions made to the sample of participants in each cohort (18 months and 36 months) and how we arrived at our analytic sample. We also reference this Figure on page 10 of the Methods, first paragraph of 'Analysis': *"After pooling the 18- and 36-month samples (n=1,331), respondents with missing data required to classify them into one of the cannabis use status categories (n=30) were removed (Figure 1). Respondents missing data on sociodemographic, work, condition, and/or health-related variables were also removed (n=105). Participants missing information on household income or nature of injury/illness were assigned a missing category due to the amount of missing. This left 1,196 respondents (n=868 no use, n=169 use for work-related condition, n=159 use unrelated to the work-related condition)."*

It is also not clear how workers would be classified if they reported using cannabis for both work-related and non-work-related reasons.

Authors' response: We agree this is an important point to clarify. Participants were not asked whether their use of cannabis was exclusively for their work-related condition and it is certainly

possible that workers who endorsed using cannabis for their work-related condition may have also been using cannabis for other reasons (e.g., for non-medical purposes, for other medical conditions).

To clarify this issue, we have made the following revision to the Methods under 'Cannabis use status' on page 8: *"Participants reporting use on more than one occasion in the past year were asked whether they were currently using or had used cannabis in the past 12 months at least in part for the treatment of conditions arising from their work-related injury or illness (yes/no). Using this information, participants were categorized into one of three categories to describe their cannabis use status: no past-year use, past-year use for their work-related condition, and past-year use unrelated to their work-related condition. Note that workers endorsing use for their work-related condition may not have been using cannabis exclusively for this condition."*

In the results section, the authors reported demographical differences between the 3 groups based on cannabis use status, with most claimants reporting no past year cannabis use. Claimants who reported using cannabis for work related condition were likely to be male, born in Canada, have longer claim duration, not working, report more pain interference and severity, and use opioids. These claimants were also more likely to report daily use for treatment of their work-related condition (e.g. pain, mental health) and perceive to have decreased use of other prescription medications. Despite these reports, most of the claimants did not have medical authorization although around 30% of those using cannabis for work related injuries received some guidance from a health care provider.

Discussion and comments

The authors found that among their sample of 1000 claimants of Ontario's workers compensation benefits resulting in lost-day, 14% reported using cannabis for the treatment of their work-related condition. They overall had positive perception of the cannabis of their health, but few received physician guidance or medical authorization. Further, these workers are more likely to experience pain, prolonged recovery, poor mental health, and difficulties with sleep. Given the cross-sectional nature of the study, it is not possible, as the authors point out, to comment on cause and effect. It is not clear if these workers are using cannabis because of their difficult recovery or cannabis use is having a detrimental effect on their recovery. The authors have adequately discussed the limitations of the study which include cross-sectional design, recall bias, generalizability issues given the specific cohort studied.

This is a hypothesis generating study in a unique cohort- injured workers. Delayed recovery and return to work can have significant impact on workers' mental and physical health, and understanding how cannabis use can affect the recovery process is a very salient issue in Canada today. What is undeniable is that a high percentage of injured workers can using cannabis for therapeutic purposes related to their workplace injury. The study highlights the opportunity for compensation boards to provide cannabis related healthcare guidance to workers return to work process. Future studies may wish to examine if cannabis use has a positive or detrimental impact on successful return to work in this population.

Authors' response: Thank you for your comments.

Reviewer: 2
Prof. Iain McGregor, University of Sydney

Comments to the Author:
The manuscript by Carnide et al provides a unique insight into the medical and non-medical use of cannabis by Canadian workers recovering from work-related injuries and illnesses. It involves a relatively straightforward survey and/or interview of a sample of workers' compensation claimants either at 18 or 36 months following their occupational injury/illness.

Some 27.4% of the 1196 interviewees used cannabis, with around half of those using cannabis for their work-related condition (the final analysis for on n=147 for a work-related condition and n=140 using cannabis for other reasons). Around half of those using cannabis for a work-related condition started using cannabis to the treat that condition.

Those using cannabis for the occupational injury had longer claim durations, were more likely to be unemployed, had poorer health, and were more distressed, and experienced more pain and insomnia. Cannabis use was associated with reduced use of prescription meds. Many of those interviewed were not receivng healthcare guidance around their cannabis use.

Overall, I found this manuscript well written and of significant interest and only have some minor comments and suggestions for the authors.

1. Can the authors provide information on what a 'work-related illness' (rather than injury) might be. An injury is easy to understand (e.g. those listed at bottom of Table 1) but what is a typical "illness"? WSIB data were collected but not reported?

Authors' response: Thank you for your comments.

The data described in Table 1 on the original work-related condition were obtained from the WSIB data. We should note that, when re-examining the data around type of work-related condition, we identified an additional 11 cases that were inadvertently coded as missing. We have now updated the categories for these 11 workers in Table 1, such that the degree of missing is now 131, rather than 142. The remaining 131 workers who are missing data on type of work-related condition are individuals who did not consent to linking their WSIB data to interview data.

Work-related illnesses include infectious and parasitic diseases, nervous system diseases, respiratory system diseases, systemic poisonings, and skin and subcutaneous tissue disorders. In Table 1, these are included in 'Other conditions', along with traumatic injuries (e.g., amputations, electrocutions). We made the decision to collapse these two groups into an 'Other conditions' category due to small cell sizes for traumatic injuries.

We have added the following footnote in Table 1, referring to 'Other conditions': *"[2] Includes traumatic injuries (e.g., amputations, electrocutions) and illnesses (e.g., infectious and parasitic diseases, nervous system diseases, respiratory system diseases, systemic poisonings, and skin and subcutaneous tissue disorders)."*

2. What proportion of illness is psychological i.e. are conditions such as trauma in first responders, or anxiety in those subjected to workplace bullying, represented in the cohort?

Authors' response: This is an important question. In fact, the original eligibility criteria only included workers with claims for *physical* injuries and diseases and excluded workers with primary psychological claims.

We have clarified the inclusion of physical conditions in ‘Methods’ under ‘Sample and Recruitment’ on pages 5-6: *“Cross-sectional data were drawn from the Ontario Life After Work Injury Study (OLAWIS), pooling two cohorts exploring the health and labour market outcomes of workers in Ontario, Canada following a physical work-related injury or illness (herein referred to as work-related condition).[26]”*

We have also added a statement about the exclusion criteria in ‘Methods’ under ‘Sample and Recruitment’ on page 6: *“Workers with a primary psychological injury, workers in the survivors programme or serious injury programme, and those who had a traumatic head injury resulting in communication impairment were excluded.”*

3. The relationship between return to work and the data collected at the 18 and 36 month time points is not entirely clear. What proportion of the cohort had returned to their original jobs? If time off work is short in some of the cohort how reliable is their recall over a 3 year period? Has cannabis use occurred throughout the 18 or 36 month interval?

Authors’ response: We apologize for the confusion. Information on current work status was collected at the time of the interview (at 18 or 36 months) and does not involve any recall. At each interview, we also asked workers about their use of cannabis in the previous 12 months, including frequency of use.

In the Methods, under ‘Cannabis use status’ on page 8, we indicate the timing of cannabis use measurement: *“Participants were asked about the frequency of their past-year cannabis use on a 7-point scale, ranging from never to every day.[32] Participants reporting use on more than one occasion in the past year were asked whether they were currently using or had used cannabis in the past 12 months at least in part for the treatment of conditions arising from their work-related injury or illness (yes/no).”*

In the Methods, in the first paragraph under ‘Sociodemographic, work, condition, and health characteristics’ on page 9, we indicate the timing of work status: *“Self-reported data were collected on age, sex, birth country, highest level of education, household income, self-reported financial difficulties in the past year, and employment status at the time of interview.”*

However, we do not have information on when workers may have initiated use after injury, nor if there were interruptions in use. We have revised the original statement referencing timing of cannabis use in the Discussion on page 26 to address this: *“Data were collected at 18 and 36 months after injury/illness onset and we lack information on how soon after injury/illness cannabis use was initiated. We also lack information on the duration of use, including whether there were any interruptions in cannabs use. Information on trajectories of use should be captured in future inception cohorts.”*

In relation to work status, we also lack temporal data on cannabis use and work status (i.e., we cannot determine whether cannabis use preceded or followed any attempts to return to work). We have made a revision to the previous sentence discussing the limitation of the timing of the data in the Discussion, on page 23 (that also includes edits to address Reviewer 2's comment #8): *"Unfortunately, as a result of the cross-sectional design of this study, we lack temporal information on cannabis use and these recovery indices, limiting interpretation of the direction of these findings. One potential explanation for these paradoxical findings is that workers with more severe symptoms may be more likely to pursue the use of cannabis as a therapeutic measure, particularly if other treatments have failed.[48-50] Furthermore, given workers were asked their perceptions of the impact of use, it is possible that benefits were overstated. Longitudinal studies should be conducted to better understand the impact of cannabis use in this population on objective recovery measures, including the impact on return-to-work."*

Finally, when asking about work status, we did collect information on whether workers had returned to their at injury/illness employers. The values are as follows:

Characteristics	**Overall (n=1,196)**	**Did not use cannabis in past 12 months (n=868)**	**Used can work-rela (n=169)**
Employment status at time of interview, n (%)			
Working with injury/illness employer	654 (54.7)	506 (58.3)	66 (39.1)
Working, different employer	207 (17.3)	139 (16.0)	32 (18.9)
Not working	335 (28.0)	223 (25.7)	71 (42.0)

We have updated Table 1 with this new information. We have also revised the following statements in the Results on page 12: *"A higher percentage of respondents reporting use for their work-related condition reported having concerning or serious financial difficulties in the past year (47.9%) and a longer claim duration (68.1%) than did those using cannabis unrelated to their work-related condition and those not using cannabis (both p<.0001). Similarly, respondents using cannabis for their condition were more likely to report not working (42.0%) and less likely to report working with the at injury/illness employer (39.1%) (p<.0001)."*

4. The cannabis use data presented is somewhat impoverished: users only had to use cannabis on more than one occasion in the past year to be included in the cannabis-using cohort. A large proportion of the cohort reporting use for their WRC (i.e. around 50%) are using cannabis weekly or less which does question the relevance/importance of their cannabis use in relation to treatment of their occupational injury. Can this be commented upon? Don't typical medical users tend to be daily users?

Authors' response: Thank you for your comments. There are a couple of reasons for why we chose not to limit our cannabis use definition to more frequent use. First, given the complete absence of data on cannabis use in this population, we saw this study as an opportunity to provide an initial, broad stroke examination of the extent and nature of cannabis use after a work-related injury/illness.

Second, the sampling strategy for this study was designed so that workers with varying durations of work disability were recruited. As such, workers who participated in this study are not necessarily individuals with chronic symptoms, for whom we may expect daily use to be more prominent. Rather,

the study also includes some workers who likely have fully recovered and others who may only be experiencing symptoms intermittently. This latter group may use cannabis less frequently or on an as-needed basis. Among those with continued symptoms (chronic or intermittent), severity of symptoms may also vary and influence frequency of use. As a result, we felt this diversity in frequency of use should still be captured.

When looking at the literature, we agree that many studies of patient populations have found that individuals typically use cannabis daily.(1-3) However, a number of other studies have found frequency of use appears to be more variable.(4-7) With that said, we agree with the reviewer that we likely included a diverse group of workers who ascribe varying degrees of importance to cannabis in treating their work-related condition.

We have added a couple of paragraphs to the Discussion on pages 24-25 to comment on the differences in patterns of use between the two groups of workers using cannabis related to/unrelated to their work-related condition. Specifically on page 24, we comment on the issue of frequency of use: *"Differences in patterns of use among workers using cannabis were also apparent. Workers using cannabis for their work-related condition used cannabis more frequently (70.8% at least once per week) compared with workers using cannabis unrelated to their condition (55.0%). Daily use was also more common among workers using cannabis for their work-related condition (39.5% versus 27.1%). Prior studies have demonstrated variability in frequency of use among adults using cannabis therapeutically.[51-57] While daily use among workers using cannabis for their condition in our study was less common than in some studies of medical cannabis use,[54-56] it is likely a function of the nature of recruitment, whereby we included workers with varying durations of work disability. As such, workers who participated in this study are not necessarily individuals with chronic, daily symptoms, for whom we may expect daily use to be more prominent. Furthermore, we defined workers as using cannabis if they reported use more than once in the previous year, to ensure we were able to capture the extent and nature of cannabis use in this population for which little data exist. As a result, it is likely we included a diverse group of workers in our sample who ascribe varying degrees of importance to cannabis in treating their work-related condition."*

VERSION 2 – REVIEW

REVIEWER	McGregor, Iain University of Sydney, Lambert Initiative for Cannabinoid Therapeutics
REVIEW RETURNED	27-Jun-2023

GENERAL COMMENTS	All my concerns have been addressed in this thorough revision.